

ABSTRACT

The present invention provides drilling systems for drilling subsea wellbores. The drilling system includes a tubing that passes through a sea bottom wellhead and carries a drill bit. A drilling fluid system continuously supplies drilling fluid into the tubing, which discharges at the drill bit bottom and returns to the wellhead through an annulus between the tubing and the wellbore carrying the drill cuttings. A fluid return line extending from the wellhead equipment to the drilling vessel transports the returning fluid to the surface. In a riserless arrangement, the return fluid line is separate and spaced apart from the tubing. In a system using a riser, the return fluid line may be the riser or a separate line carried by the riser. The tubing may be coiled tubing with a drilling motor in the bottom hole assembly driving the drill bit. A suction pump coupled to the annulus is used to control the bottom hole pressure during drilling operations, making it possible to use heavier drilling muds and drill to greater depths than would be possible without the suction pump. An optional delivery system continuously injects a flowable material, whose fluid density is less than the density of the drilling fluid, into the returning fluid at one or more suitable locations the rate of such lighter material can be controlled to provide supplementary regulation of the pressure. Various pressure, temperature, flow rate and kick sensors included in the drilling system provide signals to a controller that controls the suction pump, the surface mud pump, a number of flow control devices, and the optional delivery system.